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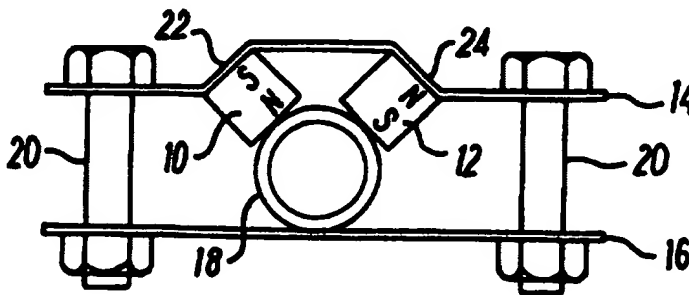
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(54) Title: MAGNETIC TREATMENT OF FLUIDS

(57) Abstract

A device for the magnetic treatment of fluids comprises a plurality of neodymium-based permanent magnets (10, 12) mounted around a fluid conduit (18) by means of suitable brackets or housing (14, 16). In the treatment of gas and liquid fuels, for improved combustion efficiency, and in the treatment of water, the magnets are oriented with dissimilar poles adjacent the conduit. In bench tests, the use of the devices was shown to produce consistent improvements in diesel engine performance and fuel consumption across a range of engine speeds and loads.



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1 Magnetic Treatment of Fluids

2

3 The present invention relates to apparatus for
4 magnetically treating fluids. In the case of liquid or
5 gas fuels, the apparatus enhances the combustion
6 efficiency, by application of the invention to fuel
7 supply lines. In the case of water, the invention
8 serves to reduce the deposition of solids from the
9 water.

10

11 There have been numerous proposals for devices making
12 use of permanent magnets (and electric fields) in fluid
13 treatment for the various purposes stated above.
14 However, these have all been relatively complex in
15 structure, involving elaborate casings and brackets,
16 encapsulated magnets, and magnets machined to specific
17 shapes. These factors all have the effect of increasing
18 the cost of the devices. The relatively low strength of
19 the magnetic materials used in such devices has also
20 limited their effectiveness in use. In addition, none
21 of the prior devices known to the present Applicants
22 have been effective in enhancing the performance of
23 diesel fuel engines. Examples of prior devices are
24 disclosed in GB-A-1189888, US-A-2652925, US-A-3228878,

1 US-A-2939830, US-A-3349354, US-A-4146479, US-A-4153559,
2 US-A-4210535, US-A-4367143, US-A-4372852 and US-A-
3 4605498.

4
5 It is an object of the present invention to provide
6 improved devices for magnetic treatment of fluids. The
7 primary object of the invention is to provide devices
8 exhibiting improved effectiveness in fluid treatment. A
9 second object of the invention is the provision of
10 devices which are simple in construction and flexible
11 in use. A further object of the invention is the
12 provision of magnetic fluid treatment devices which are
13 effective in improving the performance of diesel
14 engines.

15
16 In accordance with the invention there is provided a
17 magnetic fluid treatment device comprising a plurality
18 of permanent magnets and bracket means adapted, in use,
19 to hold said magnets in a predetermined orientation
20 about a fluid conduit, wherein said magnets are formed
21 from neodymium-based magnetic material.

22
23 Preferably, said magnets are oriented with their polar
24 axes extending substantially radially from the central
25 axis of said conduit.

26
27 Preferably also, in the treatment of gas and liquid
28 fuels for improved combustion efficiency, and in the
29 treatment of water, said magnets are oriented with
30 differing poles adjacent said conduit. Most preferably,
31 there is at least one magnet located at a first
32 location with its north pole adjacent the conduit and
33 at least a second magnet located at a second location
34 with its south pole adjacent the conduit.

35

1 Preferably also, said bracket means comprise at least
2 an upper and a lower bracket, adapted to be secured
3 together around a conduit, at least one of said
4 brackets providing a seating surface for at least one
5 of said magnets.

6
7 In accordance with a second aspect of the invention
8 there is provided a magnetic fluid treatment method
9 comprising mounting a plurality of neodymium-based
10 permanent magnets in a predetermined orientation about
11 a fluid conduit.

12
13 Embodiments of the invention will now be described, by
14 way of example only, with reference to the accompanying
15 drawings in which:

16
17 Fig. 1 is a schematic sectional view showing a
18 first embodiment of the invention installed on a
19 first tubular conduit;

20
21 Fig. 2 is a schematic sectional view showing a
22 second embodiment of the invention installed on a
23 second tubular conduit;

24
25 Fig. 3 is a plot of average fuel consumption
26 rate against load, for a range of engine
27 speeds, in bench tests of a diesel engine
28 with and without devices in accordance with
29 the invention; and

30
31 Figs. 4(a) and (b) respectively are plots of
32 brake thermal efficiency versus brake power
33 and brake specific fuel consumption versus
34 brake power, at an engine speed of 2000rpm,
35 in bench tests of a diesel engine with and

1 without devices in accordance with the
2 invention.

3
4 Referring now to the drawings, Fig. 1 shows a magnetic
5 fluid treatment device comprising first and second
6 permanent magnets 10, 12, an upper mounting bracket 14
7 and a lower baseplate 16 installed on a tubular conduit
8 18, typically a 6 mm diameter fuel line. The device is
9 secured to the conduit by means of bolts 20 or the like
10 fastening the upper bracket 14 and the lower baseplate
11 16 to one another.

12
13 The upper bracket 14 has an angled sectional profile
14 providing first and second angled magnet seating
15 surfaces 22, 24 which retain the magnets 10, 12 in the
16 desired orientation. In this example the magnets are
17 disposed with their polar axes extending substantially
18 radially through the conduit, the angle of intersection
19 of said polar axes being approximately 90 degrees. The
20 brackets are suitably of coated metal strip material,
21 approximately 3 mm in thickness.

22
23 In the case of gas and liquid fuels (including petrol,
24 diesel-oil and kerosene) the magnets 10, 12 are
25 oriented with opposite poles adjacent the conduit. This
26 is also the case for the treatment of water.

27
28 Fig. 2 shows a second embodiment of the invention
29 comprising first and second magnets 26, 28, and upper
30 and lower mounting brackets 30, 32, installed on a
31 relatively larger tubular conduit 34, typically a 22 mm
32 diameter pipe as used for water and in gas or oil fired
33 boilers.

34
35 In this case, the brackets are each angled and each

1 provide a seating surface 36, 38 for one of the two
2 magnets 26, 28, which are located on opposite sides of
3 the conduit 34. The brackets are again secured in
4 position by means of bolts 40, 42 or the like. The
5 polar orientation of the magnets with respect to the
6 conduit is the same as for the previous embodiment:
7 opposite poles adjacent the conduit for the treatment
8 of fuels and water; south poles adjacent the conduit
9 for the treatment of water.

10

11 Where the devices of Figs. 1 and 2 are applied to fuel
12 lines, the efficiency of fuel combustion is enhanced,
13 and when applied to water pipes the deposit of solids
14 is reduced and the build up of deposits such as lime
15 scale is reduced accordingly. In accordance with the
16 present invention, the magnets employed in the devices
17 are high strength neodymium type magnets, suitably
18 Neorem magnets from Swift Levick Magnets Limited. These
19 magnets are many times more powerful than the types
20 employed in prior devices of this type, and the
21 effectiveness of the devices in treating fluids is
22 correspondingly enhanced.

23

24 The construction of the devices, using simple angled
25 brackets to locate the magnets on the desired conduit
26 in the required orientation, is substantially less
27 complex than in prior devices, and magnets of simple,
28 standard geometrical configurations may be used. The
29 brackets might comprise simple moulded housings of
30 plastics or other suitable materials, configured to
31 suit the shape and desired orientation of the magnets.

32

33 Whereas previous magnetic fluid treatment devices have
34 been found to be ineffective in enhancing the
35 performance of diesel engines, devices in accordance

1 with the present invention have been found to produce
2 consistent improvements in diesel engine performance
3 when mounted on fuel lines adjacent the fuel injectors.

4
5 The effects of the use of the devices on the
6 performance and fuel consumption of diesel engines was
7 tested in bench tests using a Perkins T4.236 diesel
8 engine with turbocharged injection. The magnets used
9 were type N410A, formed from iron, neodymium and boron
10 using the powder metallurgical process and shaped by
11 uniaxial pressing. The typical tolerances of such
12 sintered, uniaxially pressed magnets are $\pm 1\%$. The
13 typical physical and mechanical properties of the
14 magnets were as follows:

15			
16	Curie Temperature ($^{\circ}\text{C}$)	-	310
17	Hardness (HVS)	-	500 - 600
18	Tensile Strength (N/mm^2)	-	80 - 100
19	Density (g/cm^3)	-	7.5
20	Electrical Resistivity ($\mu\Omega\text{cm}$)	-	140 approx.
21	Specific Heat (J/kgK)	-	500
22	Magnetising Field (kA/m)	-	2500

23
24 The nominal values of remanence, coercivity and energy
25 product were 1.15T, 870 kA/m and 250 kJ/m³,
26 respectively. Each magnet was of cylindrical shape of
27 approximately 27mm diameter and 15mm height and was
28 housed in a plastic case having flanges and channels
29 for clamping about a pipe.

30

31 The Perkins diesel engine T4.236 engine with
32 turbocharged injection used in the tests had a maximum
33 speed governed at 2800rpm with 23% torque back-up over
34 1400rpm. The bore diameter and stroke of the engine
35 were 98.4mm and 127mm respectively. The engine had

1 four in-line cylinders and a capacity of 3.86 litres,
2 running on four stroke with a firing order 1-3-4-2 and
3 a compression ratio of 16:1. The engine drove a
4 dynamometer (Dyno Mark 1, manufactured by Heenan and
5 Froude Limited).

6

7 The set-up was controlled by a computer and fully
8 instrumented to measure various temperatures,
9 pressures, fuel consumption rate, brake load and speed.

10

11 The procedure of the experiment was as follows:

- 12 1. Without the magnets, the engine was
13 started and allowed to run until thoroughly
14 warm.
- 15 2. The engine was set to run at 1200rpm and
16 drag load.
- 17 3. A fuel logging program was run to record
18 fuel consumption for the period 10 to 30
19 seconds.
- 20 4. The time elapsed and fuel consumption were
21 noted and the fuel consumption rate calculated
22 therefrom.
- 23 5. Steps 3 and 4 were repeated for different
24 loads from 20Nm to 100Nm in 10Nm increments.
- 25 6. Steps 2 to 5 were repeated for different
26 speeds up to 2800rpm in 200rpm increments.

27

28 The experiment was repeated once, again without the
29 magnets, two days later.

30

31 The experiment was then repeated twice with the magnets
32 having been mounted on the four fuel injection pipes
33 while the engine was cold. Again, there were two days
34 between tests.

35

1 The test results showed substantial consistency between
2 the first and second trials both with and without the
3 magnets.

4
5 Fig. 3, shows a plot of average fuel consumption rate
6 against the load for different engine speeds, where the
7 dotted lines indicate results without the magnets and
8 the solid lines indicate results with the magnets
9 fitted. It can be seen that the fuel consumption rate
10 increases as load increases for each particular speed,
11 and as the speed increases for a particular load. It
12 can clearly be seen that the fuel consumption rate is
13 consistently lower with the use of the magnets than
14 without the magnets.

15
16 Fig. 4 shows plots of: (a) brake thermal efficiency
17 versus brake power; and (b) brake specific fuel
18 consumption versus brake power for an engine speed of
19 2000rpm, where the dotted lines again indicate results
20 without the magnets and the solid lines indicate
21 results with the magnets fitted. These plots show that
22 both the brake thermal efficiency and the brake
23 specific fuel consumption were consistently improved by
24 the use of the magnets across a range of loads.
25 Similar improvements were recorded across the full
26 range of engine speeds from 1200rpm to 2800rpm. The
27 improvements were generally more apparent at higher
28 speeds and loads, but there were consistent
29 improvements across all speeds and loads.

30
31 The test results indicate that devices in accordance
32 with the invention provide consistent, significant
33 improvements in engine efficiency and fuel consumption
34 when employed on the fuel lines of diesel engines.

35

1 The invention thus provides improvements in magnetic
2 fluid treatment devices, with respect both to the
3 effectiveness and the construction of such devices, and
4 provides a means whereby the operation of diesel
5 engines may be significantly improved by magnetic
6 treatment.

7
8 Modifications and improvements may be incorporated
9 without departing from the scope of the invention.
10

1 **Claims**

2

3 1. A magnetic fluid treatment device comprising a
4 plurality of permanent magnets and bracket means
5 adapted, in use, to hold said magnets in a
6 predetermined orientation about a fluid conduit,
7 wherein said magnets are formed from neodymium-based
8 magnetic material.

9

10 2. A device as claimed in Claim 1, wherein said
11 magnets are oriented with their polar axes extending
12 substantially radially from the central axis of said
13 conduit.

14

15 3. A device as claimed in Claim 1 or Claim 2, wherein
16 in the treatment of gas and liquid fuels for improved
17 combustion efficiency, and in the treatment of water,
18 said magnets are oriented with differing poles adjacent
19 said conduit.

20

21 4. A device as claimed in Claim 3, wherein there is
22 at least one magnet located at a first location with
23 its north pole adjacent the conduit and at least a
24 second magnet located at a second location with its
25 south pole adjacent the conduit.

26

27 5. A device as claimed in any preceding Claim, wherein
28 said bracket means comprise at least an upper and a
29 lower bracket, adapted to be secured together around a
30 conduit, at least one of said brackets providing a
31 seating surface for at least one of said magnets.

32

33 6. A magnetic fluid treatment method comprising
34 mounting a plurality of neodymium-based permanent
35 magnets in a predetermined orientation about a fluid

1 conduit.

2

3 7. A method as claimed in Claim 6, wherein said
4 magnets are oriented with their polar axes extending
5 substantially radially from the central axis of said
6 conduit.

7

8 8. A method as claimed in Claim 6 or Claim 7, wherein
9 in the treatment of gas and liquid fuels for improved
10 combustion efficiency, and in the treatment of water,
11 said magnets are oriented with differing poles adjacent
12 said conduit.

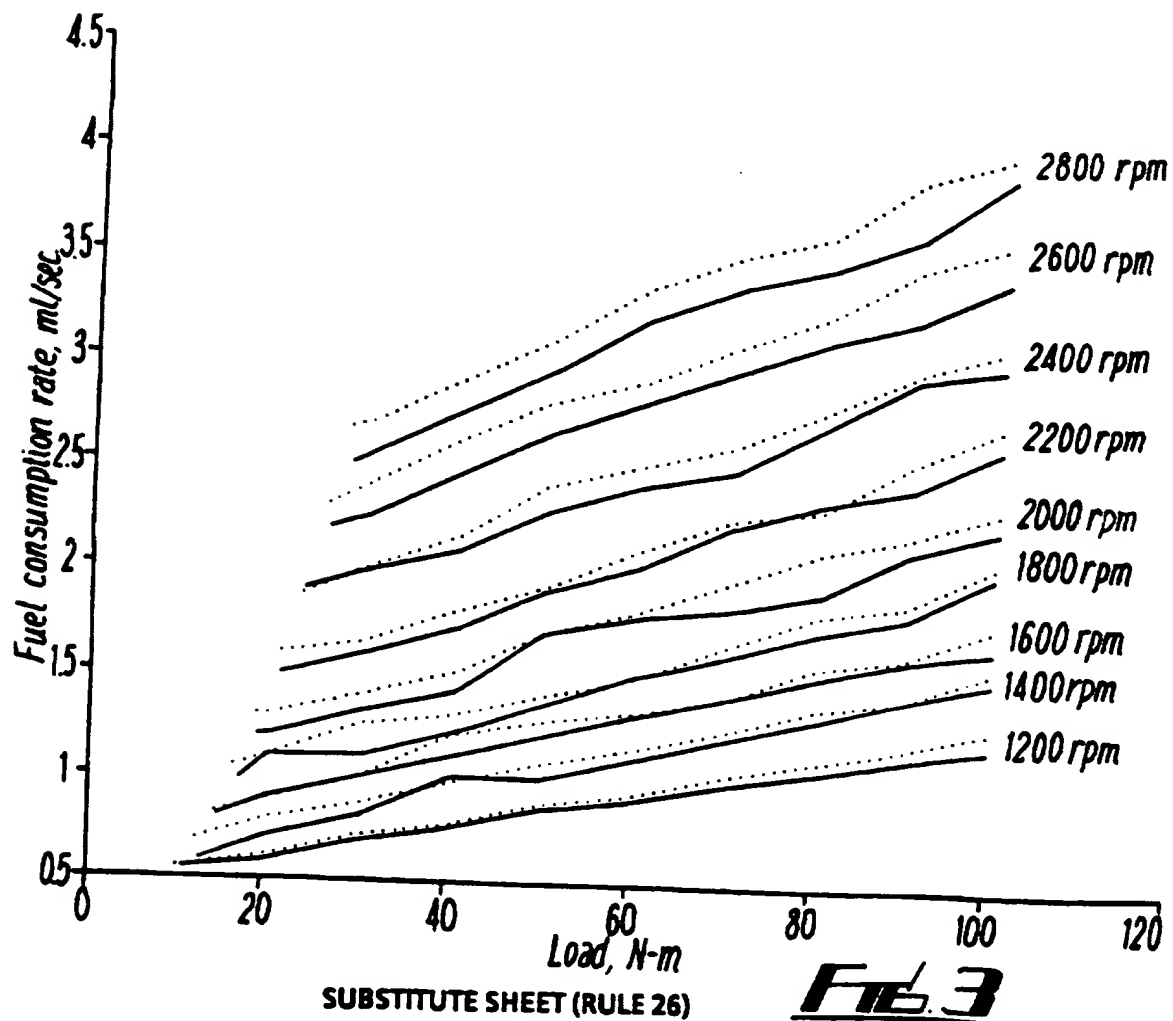
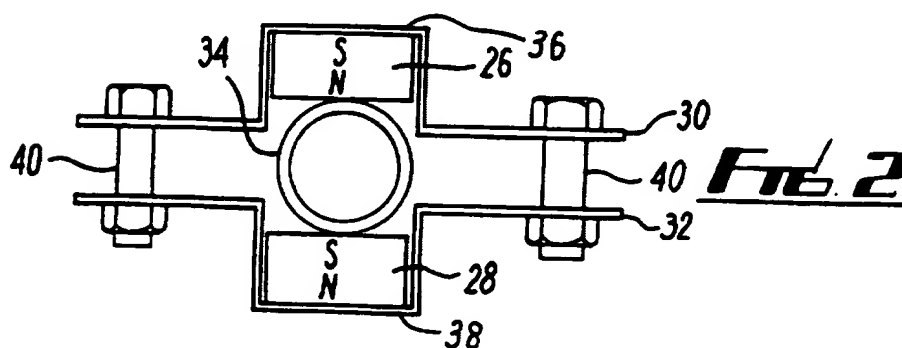
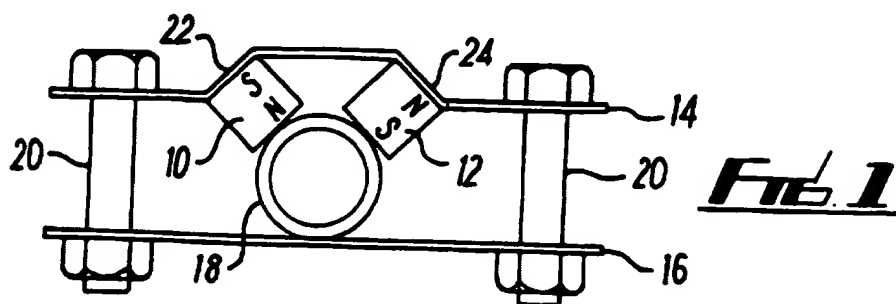
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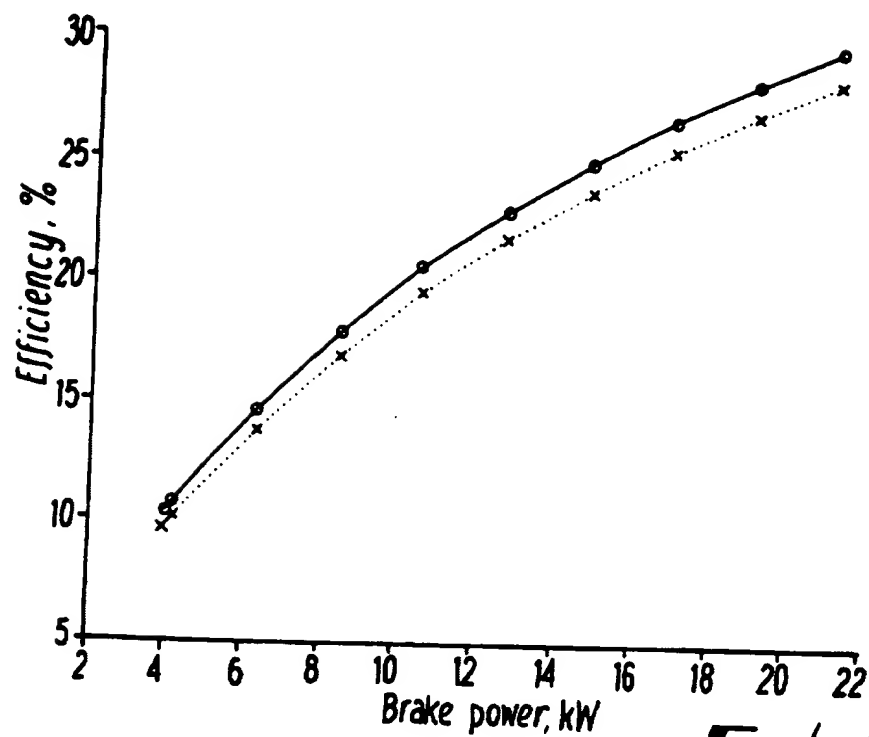
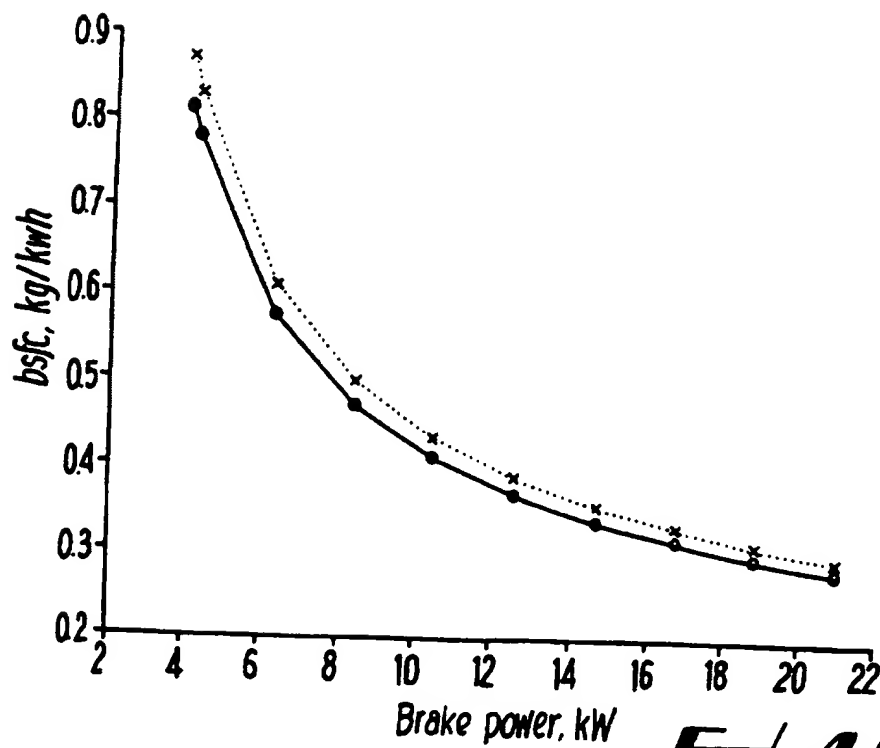
14 9. A method as claimed in Claim 8, wherein at least
15 one magnet is located at a first location with its
16 north pole adjacent the conduit and at least a second
17 magnet is located at a second location with its south
18 pole adjacent the conduit.

19

20 10. A method as claimed in any one of Claims 6 to 9,
21 wherein said magnets are located on said conduit by
22 bracket means comprising at least an upper and a lower
23 bracket, adapted to be secured together around a
24 conduit, at least one of said brackets providing a
25 seating surface for at least one of said magnets.
26

1/2



**FIG. 4(a)****FIG. 4(b)**

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 95/02344

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F02M27/04 C02F1/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F02M C02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,5 055 189 (ITO MASASHI) 8 October 1991 see claims 1,3; figures ---	1-10
X	EP,A,0 392 097 (ITO MASASHI) 17 October 1990 see claims 1,3; figures ---	1-10
X	EP,A,0 501 589 (ZWOLLE HANDELSBURO) 2 September 1992 see claims 1,2; figure 2 ---	1,6
X	US,A,5 269 916 (CLAIR COLONEL) 14 December 1993 see column 2, line 50 - line 52; figures ---	1-4,6-9
	-/--	

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PCT/GB 95/02344

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,5 269 915 (CLAIR COLONEL) 14 December 1993 see column 4, line 64 - line 66; figures ---	1,6
X	DE,U,91 16 358 (STRAUB) 20 August 1992 see claim 3; figure -----	1,6

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Information on patent family members

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PCT/GB 95/02344

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